INTERSESSIONAL PANEL OF THE UNITED NATIONS COMMISSION ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD)

Geneva, Switzerland
18-22 January 2020

Contribution by UNOOSA

to the CSTD 2020-2021 priority theme on "Using science, technology and innovation to close the gap on Sustainable Development Goal 3 on good health and well-being"

PRIORITY THEME 2: Using science, technology and innovation to close the gap on SDG 3, good health and well-being

United Nations Commission on Science and Technology for Development (CSTD)

Dear international organization/UN entity/agency,

The CSTD 23rd annual session selected "Using science, technology and innovation to close the gap on SDG 3, good health and well-being" as one of the priority themes for its 24th session (2020-21 period).

Science, technology, and innovation (STI) can play an important role in strengthening the capacity of all countries, in particular developing countries for early warning, risk reduction and management of national and global health risks as described in SDG 3D. Data science, biomedical science and engineering and other technologies can broadly transform health and medicine and specifically support countries and regions in their responses to emerging health crises as well as in their preparedness for future threats. Beyond specific technological innovations, STI policy advice, diplomacy, and international cooperation also play a prominent role in current and future infectious disease preparedness and response. The theme will explore experiences about using STI to strengthen health outcomes as well as approaches to regional and global STI cooperation in this field.

The CSTD secretariat is in the process of drafting an issues paper on the theme to be presented at the CSTD inter-sessional panel meeting. In this context, we would like to solicit inputs from international organizations, UN entities and agencies on this theme. We would be grateful if you could kindly answer the following questions based on your organization's work at the global level.

1. Can you give examples of international projects/policies aimed at using science, technology, and innovation for early warning, risk reduction and management of national risks? What are the main challenges confronted while trying to implement these projects/policies?

Space applications provide innovative tools to improve lives and accelerate sustainable development in many areas, and health is one of them. ***UNOOSA helps all countries access the potential of space science and applications and integrate these tools in national policies and practices.*** *We present some examples of how space can help us achieve better health worldwide, and of what UNOOSA is doing to contribute to this goal, from increasing international knowledge sharing to providing ad-hoc training and resources.*
The main purpose of this page is to increase awareness about existing space-related tools and best practices that governments and organisations around the world can adopt to achieve better health for everyone.

Each year, non-communicable and communicable diseases and maternal, neonatal and nutrition-related conditions together cause an estimated 50 million deaths worldwide. Innovative approaches to solve health problems are needed to complement traditional good practices in the health sector. Such approaches include the use of space science and technology for health promotion, health protection, surveillance, health-care delivery in remote areas using telemedicine and tele-health services. Space science and technology provide innovative research platforms for advancing medical knowledge and spin-offs for the development of health-care equipment, operational activities and procedures. Space-based data and technologies foster connectivity in health emergencies, and the integration of space-derived information in health-care systems supports the mapping of populations, the treatment of diseases, the distribution of medication, transportation systems and water supply and sanitation and facilitates the monitoring of trends in air quality and health-related environmental factors.

Space science and technology provide important tools that can support public health stakeholders in planning, research, prevention, early warning, alerts and health-care delivery. Information derived

from Earth observation and meteorological satellites in combination with geographic information and global navigation satellite technologies has increasingly been used to study disease epidemiology, enabling increased use of spatial analysis to identify the ecological, environmental, climatic and other factors that can have a negative effect on public health or can contribute to the spread of certain diseases. United Nations entities assist developing countries in making use of space-based solutions to fight the spread of these diseases.

Satellite communications are essential for tele-health and for the management of epidemics in cases involving natural or human-made disasters. Early warning and disaster preparedness rely on data collected by satellites and validated by fieldwork. Such data products, when incorporated in a geographical database, could be used to develop spatial models for predicting high-risk areas. Space stations and their Earth-bound analogues serve as platforms for health studies. Efforts are also being made to promote international cooperation in the peaceful uses of outer space for economic, social and scientific development, in particular for the benefit of developing countries. Priorities include building indigenous capability in space policy, science and technology in the area of global health.

2. Could you share specific examples, projects or initiatives that have used frontier technologies (e.g., AI, drones, blockchain, 3D printing, etc.) or other forms of innovation in general in addressing the Covid-19 pandemic?

In order to help bridge the information crisis that has accompanied the global pandemic, UNOOSA's programme UN-SPIDER compiled ***examples of contributions and best practices*** *using space in addressing COVID-19. These resources can be accessed via: https://un-spider.orgadvisory-support/emergency-support/covid-19*

3. Can you provide examples of policies/projects/initiatives aimed at strengthening health innovation systems at the global level? For example, how does your organization support the building of innovative capabilities through investments in R&D and human capital? What projects are in place to stimulate healthcare innovation and effectively address safety, ethical and other concerns?

PROGRAMME ON SPACE APPLICATIONS

UNOOSA Programme on Space Applications *provides capacity building in the areas of telehealth and tele-epidemiology (landscape epidemiology), assists Member States to use satellite remote sensing, global positioning, GIS and satellite communications to integrate ecological, environmental and habitation data into models for disease surveillance and control activities. The Programme* ***regularly organises or contributes to workshops, conferences and training programmes*** *on leveraging space for global health. See a list of some of these recent activities here .*

Under its ***Access to Space 4 All Initiative****, UNOOSA provides a variety of opportunities to all UN Member States, in particular developing countries, to access space, for example by developing a cube satellite to be deployed from the International Space Station or by conducting experiments onboard the China Space Station.*
Some of these programmes provide winning teams with the opportunity to conduct medical research or experiments that can lead to advancements in healthcare thanks to the unique space conditions. For example, the 2nd cycle of HyperGES (Opportunity on Experiments under Hypergravity condition) that will be open in the 2nd half of 2020, will allow health experiment or research in microgravity conditions.

WORKING GROUP ON SPACE AND GLOBAL HEALTH

In 2018, the ***Committee on the Peaceful Uses of Outer Space (COPUOS)*** *agreed to introduce a new item on space and global health in the agenda of the Scientific and Technical Subcommittee (STSC), and also agreed to establish a Working Group under that agenda item. UNOOSA serves as Secretariat to this intergovernmental platform. The* ***Working Group on Space and Global Health*** *is gathering information from States members and international organizations about their use of space applications for global health to develop concrete recommendations. It will aim to establish a platform to enhance the sharing of information, best practices, tools and capacity-building resources in the area of space and global health. Comprehensive information and documentation of the Working Group, including information provided by States members, and other sources addressing synergies in international cooperation and coordination in the use of space tools for global health, such as the UN-Space special report on the use of space science and technology within the United Nations system for global health, are available systematically on the dedicated webpage of the Working Group: https://www.unoosa.org/oosa/en/ourwork/copuos/stsc/gh/index.html*

4. Could you share case studies of international cooperation that have strengthened health capacities, particularly in developing countries? Can you provide success stories involving global cooperation in academic research networks, STI diplomacy, or initiatives to make healthcare innovations accessible for all?

Tele-epidemiology

In the area of health protection, space technology is well suited to the dynamic nature of outbreaks and epidemics of infectious diseases. Tele-epidemiology is employed by United Nations entities in cooperation with a diverse community of partners to provide information and develop models to support outbreak awareness, preparedness, response and control strategies. Tele-epidemiology combines the use of information from satellite-based platforms to investigate and forecast outbreaks and the re-emergence of infectious diseases. The use of remote sensing has significantly advanced the possibility to track and visualize the real-time evolution of local outbreaks and epidemics and map the environmental influences for the epidemics and critical public health infrastructure. Space-derived information is used in tele-epidemiology in programmes for specific diseases, such as yellow fever, cholera and leptospirosis, to develop a decision-support tool and to provide information for current vaccination strategies. Applications of tele-epidemiology by United Nations entities for specific situations or diseases are discussed in the sections below.

E-health

E-health is a generic term used to refer to all digital health-related information. Telemedicine and teleconsultations, electronic health records and hospital and health information systems, e-prescriptions and computer-assisted imaging are examples of modalities in e-health. In its resolution 58.28, the World Health Assembly stressed that e-health was "the cost-effective and secure use of information and communications technologies in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research".

Tele-health and telemedicine

Tele-health and telemedicine applications embrace computer and telecommunications technologies, including satellite communications, to bring medical experts into virtual contact with patients or

doctors in remote and rural areas, thus avoiding costly relocation to hospitals in urban areas, which could prove detrimental to the patients' health.

Climate and public health

According to the fifth assessment report of the Intergovernmental Panel on Climate Change, climate change is affecting health both directly, as a result of changes in temperature and precipitation and the occurrence of heatwaves, floods, droughts and fires, and indirectly, as a result of ecological disruptions brought on by climate change, such as crop failures and shifting patterns of disease vectors, or social responses to climate change, such as the displacement of populations following prolonged drought. Space-based technologies can thus contribute to the assessment of the direct effects of climate and weather on health, as well as ecosystem-mediated effects of climate change on health outcomes. 31. Space-based technologies can also be used to support operational work in the public health sector, such as mapping of the geographical distribution of meteorological events posing risks to public health and critical public health infrastructure. For example, the Vulnerability and Risk Analysis and Mapping programme of WHO uses remotely sensed and other environmental information and combines it with disaggregated vulnerability and capacity indicators to identify population and health services at risk of hazards such as floods, droughts and heatwaves and to enhance efforts to reduce disaster risk. Such technologies also have a potential to map other climate-related issues such as heatwaves and help discriminate between the effects of sudden extreme weather events and longer-term and slow-onset climate effects.

Meningitis

Meningococcal meningitis is a devastating epidemic disease in Africa, affecting the lives of individuals and communities in the "meningitis belt" of Africa, a sub-Saharan zone extending from Senegal to Ethiopia. Neisseria meningitides, the causal agent for the bacterial disease, is transmitted through respiratory droplets throughout the year, but the climate, notably hot, dry and dusty conditions, irritating the throat, appears to be favourable for invasive disease and associated epidemics. Furthermore, the timing of the epidemic year and the spatial distribution of disease cases throughout the "meningitis belt" strongly indicate a close linkage between the life cycle of the causative agent and climate variability. 34. Integrating the environmental knowledge in decision-support tools can assist health officials in predicting epidemics and devising vaccination strategies, and remote-sensing technology plays a key role in providing information on absolute humidity, absorbing aerosols, rainfall and land cover and other environmental influences relating to the epidemics.

Air pollution

Exposure to particulate air pollution — and the burden of disease — can be estimated using surface monitoring stations. The urban air pollution exposure database of the WHO Global Health Observatory already includes such data on over 1,500 cities throughout the world. However, many parts of the developing world, including urban and rural areas, are not included. As a result, scientists have been working to devise methods to combine surface monitoring data with data from satellite remote sensing and atmospheric transport models. To advance the use of air pollution disease burden estimates, WHO has begun the development of a global platform on air quality and health, building on its existing urban air pollution database, as well as available satellite remote sensing and atmospheric transport model data from leading national and scientific institutions throughout the world. Augmenting ground-based measurements and model estimates with remote-sensing data makes it possible to increase the availability of global information on key air pollutants, especially for the most highly polluted and data-poor regions.

Water quality and availability

Inadequate water, sanitation and hygiene continue to pose a major threat to human health. Water quality is continuously monitored to control water characteristics, identify trends over time, identify emerging problems, determine whether pollution control programmes are working, help design pollution control efforts and respond to emergencies such as floods and spills. Traditional monitoring of water quality involves on-site sampling of water and subsequent laboratorial analyses. While this provides accurate measurements, it is normally costly, time-consuming and indicative only of the situation at the particular points where the samples were obtained. Wider coverage of water quality observations can be obtained by satellite-based remote-sensing technology, which is suitable for near-real-time geographical coverage of water quality of inland freshwater systems, such as lakes, reservoirs, rivers and dams, and which is capable of detecting lake eutrophication, light penetration, phytoplankton bloom, chlorophyll levels, turbidity and other parameters.

Monitoring recreational waters

Lakes, rivers and seas are used for a variety of recreational activities, including swimming, diving, fishing and sailing. If these activities are to be enjoyed safely, attention must be given to health hazards such as water pollution or excessive growth of toxic cyanobacteria. Space technology, through its Earth observation applications, provides vital information for assessments and monitoring programmes for bodies of water used for recreation.

Biodiversity dynamics as an affecting factor for transmission of vector-borne diseases

Earth observation data and field data are being increasingly integrated into disease models to map and predict changes in habitats and biodiversity and calculate risks to public health. Land-use dynamics, animal reservoir mapping, the state of forest cover and water reservoirs are key determinants for the plague, Lyme disease and other vector-borne diseases. The models help environmental decision makers and public health practitioners to better understand the effectiveness of intervention measures, such as repellents, integrated pest management, land-use practices and disease treatment.

Early warning for other zoonotic diseases

A zoonosis is any disease or infection that is naturally transmissible from vertebrate animals to humans. Animals thus play an essential role in maintaining zoonotic infections. Zoonoses may be bacterial, viral or parasitic, or they may involve unconventional agents. In addition to Rift Valley fever and Japanese encephalitis, which are mentioned in the preceding paragraphs, other zoonotic diseases that have recently been the subject of increased public and media attention include anthrax, bovine spongiform encephalopathy (also known as mad cow disease), Crimean-Congo haemorrhagic fever, highly pathogenic avian influenza and the Ebola virus disease.

Since July 2006, outbreaks of major animal diseases have been monitored worldwide by the Global Early Warning and Response System for Major Animal Diseases, including Zoonoses, a joint system that builds on the added value of combining and coordinating the alert and disease intelligence mechanisms of FAO, WHO and the World Organization for Animal Health, for the international community and stakeholders to assist in prediction, prevention and control of threats of animal disease, including zoonoses, through the sharing of information, epidemiological analysis and joint risk assessment.

Early warning is based on the concept that dealing with a disease epidemic in its early stages is easier and more economical than having to deal with it once it is widespread. Satellite-derived information on climatic factors is combined with economic indicators and migration statistics and is further integrated in epidemiological analysis for predicting disease threats. From a public health perspective, early warning of outbreaks with a known zoonotic potential will facilitate the development of control measures and the formulation of relevant preventive policies.

5. Could you suggest some contact persons responsible for projects/policies, related technologies and international collaboration in this context as well as any experts dealing with projects in this area? We might contact them directly for further inputs or invite some of them as speakers for the CSTD inter-sessional panel and annual session.

UNOOSA has a wealth of contacts to experts from the field incl. the chair of the dedicated Working Group on Space and Global Health. If this specialised topic is of interest to UNCTAD and to be included in the preparatory work please feel free and reach out to markus.woltran@un.org to identify suitable speakers. UNOOSA is not in the position to share contact details without further engaging with the experts due to data protection policies.

6. Do you have any documentation, references, or reports on the specific examples on the priority theme in your organization?

Space for global health Special report of the Inter-Agency Meeting on Outer Space Activities on the use of space science and technology within the United Nations system for global health: https://www.unoosa.org/pdf/reports/ac105/AC105_1091E.pdf

Working Group on Space And Global Health:
https://www.unoosa.org/oosa/en/ourwork/copuos/stsc/gh/index.html

Space for Health Website:
https://www.unoosa.org/oosa/en/ourwork/space4health/index.html

Space for Health Webinar incl. Recordings:
https://www.unoosa.org/oosa/en/ourwork/space4health/2020/summary.html

Space for Health Webinar-Report:
https://www.unoosa.org/documents/pdf/psa/health/Webinar/Space4Health_Webinar_Report.pdf

Please send your responses and any further inputs on the theme to the CSTD secretariat (stdev@unctad.org) by 7 October 2020. We look forward to receiving your valuable inputs.

Sincere Regards,

CSTD secretariat